SUPERFUND RESEARCH AND DEVELOPMENT: THE ROLE OF R&D WITHIN A REFORMED SUPERFUND

BEFORE THE

SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE

U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

FIRST SESSION

DECEMBER 6, 1995

[No. 37]

Printed for the use of the Committee on Science

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SUPERFUND RESEARCH AND DEVELOPMENT: THE ROLE OF R&D WITHIN A REFORMED SUPERFUND

WEDNESDAY, DECEMBER 6, 1995

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
Washington, DC.

The Subcommittee met at 10:05 a.m. in Room 2318 of the Rayburn House Office Building, the Honorable Dana Rohrabacher, Chairman of the Subcommittee, presiding.

Mr. ROHRABACHER. This hearing of the Energy and Environment Subcommittee is called to order.

The Subcommittee has jurisdiction over the Superfund research program, which is authorized in HR 2500, the Superfund Reform Act of 1995. Funding for this program represents about five percent of the money spent out of the Hazardous Waste Trust Fund, whose primary purpose is the cleanup of contaminated areas. In fiscal year 1995 this came to $63 million.

The program's stated purpose is to introduce innovative technologies into the Superfund cleanup process. It does this by helping companies overcome formidable regulatory barriers.

This hearing will examine whether this program will serve a useful purpose under the reformed Superfund program.

There is no question that the existing program has prevented the free market from working by creating a regulatory climate that discourages contractors from using new technologies.

It is EPA's contention that the solution to this problem is a government solution, a program that helps companies demonstrate the value of new technologies by evaluating them and applying them to site specific uses. This program also funds research centers at academic institutions, known as exploratory centers. Some of these centers were established through competitive proposals, others by academic earmark. Other aspects of the program include research on improving risk assessment, site characterization and technical assistance to state and local officials and site managers.

Today we will look at whether EPA has succeeded in its goals for this program. We will also explore whether a reformed Superfund program will require continued government activities in these areas.

To do that we have with us Dr. Robert Huggett, EPA's Assistant Administrator for Research and Development, who administers the program, and Lawrence Dyckman, the GAO's Associate Director for

Resources, Community and Economic Development. The GAO has just completed an examination of the EPA's use of innovative technologies for site cleanup.

Before I turn to our panel let me ask my colleagues—first of all, Former Chairman Brown, whom we are very pleased to have with us today. It's always an honor having the Former Chairman of the full Science Committee with us.

Chairman Brown, do you have any opening statement that you would like to make?

Mr. BROWN. Thank you very much, Mr. Chairman. I appreciate your efforts in calling this hearing. I would like to get right on with the witnesses and I have no statement myself.

[The prepared statement of Hon. George E. Brown, Jr., follows:]

PREPARED STATEMENT OF HON. GEORGE E. BROWN, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

The Superfund research and development program represents about five percent of the total budget for Superfund. When this program was established in 1986, we thought that a small investment in R&D had the potential to yield significant returns in the form of reduced expenditures for Superfund site cleanups. As we consider the reauthorization of the Superfund program we have to evaluate the accomplishments of the program to date and to consider whether there is a need for a continued federal role in the development of environmental technologies to remediate contamination at Superfund sites.

I believe there will continue to be a role for government in the research and development of technologies to deal with hazardous materials. Whatever changes are made to the Superfund program, there will still be a need to remediate Superfund sites in a cost-effective manner, there will still be a need for improved methods of risk assessment on which to base decisions, and contamination of Superfund sites will still need to be quickly and accurately characterized. Communities will continue to expect Superfund sites to be cleaned up to a level that will not pose a threat to human health or the environment. The difficulties that firms encounter in researching, developing, and commercializing technologies to cleanup these sites or to ensure that wastes are contained will not be eliminated by removing regulatory barriers alone. The federal government can be an effective partner with the private sector in finding solutions to the problem of safe disposal and cleanup of hazardous materials.

I hope the witnesses today will provide us with an assessment of this program's accomplishments and some suggestions on how we can improve its effectiveness.

Mr. ROHRABACHER. I'd like to turn to my colleague from Indiana, Mr. Roemer, who is my new Ranking Member.

Mr. ROEMER. I don't think that's official yet, Mr. Chairman.

Mr. BROWN. He's an acting acting.

Mr. ROHRABACHER. We welcome these changes that bring people up further in the ranks on your side by transferring them to our side.

But, Mr. Roemer, why don't you go ahead if you have an opening statement.

Mr. ROEMER. Thank you, Mr. Chairman. I do have a statement.

We are here today to receive testimony on the Superfund research and development account and the future of this program under a reformed and improved Superfund program.

As a Democratic co-sponsor of HR 2500, legislation to reauthorize and reform the Superfund program, I have a strong interest in the subject matter before the Committee today.

The Superfund R&D program, as it exists today, was formed as part of the 1986 Superfund reauthorization. It has been an expensive program, yet has reduced tangible results.

Under the auspices of the SITE program, a site test program to evaluate field technologies was created to establish needed confidence in emerging cleanup sciences. A variety of companies, the majority being small businesses, have invested in and developed cutting edge technologies for the cleanup of hazardous wastes. However, companies involved in the actual cleanups of toxic waste sites were reluctant to purchase unproven technologies.

The EPA, under the SITE program, has bridged the gap between development and use by providing a proving ground for the privately developed technologies. This has given the businesses who conduct toxic cleanups the confidence in these products that was necessary to make them marketable. These cutting edge technologies in turn have cut the costs of cleanup and made them more effective. There have been less false starts, performance standards are far better, and the development of new and more efficient products has been assured. This program has been needed and has been a proper role for the EPA.

Now that Superfund is about to be reauthorized and a great deal of changes are to be made, it is appropriate for this committee, which has jurisdiction over the Superfund R&D accounts, to examine the role for R&D activity in what hopefully will be a new and improved Superfund.

The Superfund R&D program has made remediation faster and more efficient. The question before this committee today may well be how to make the Superfund R&D program faster and more efficient.

Mr. ROHRABACHER. Thank you, Mr. Roemer.

Mr. Wamp, do you have anything you'd like to say to open up?

[No response.]

Mr. ROHRABACHER. Ms. Johnson, do you have an opening statement?

Ms. JOHNSON. Thank you, Mr. Chairman.

I'm Eddie Bernice Johnson, of Dallas, Texas—district thirty. Let me thank you for calling this hearing this morning and also extend my welcome to the witnesses.

Superfund reform is one of the main legislative priorities which will be considered in this session of Congress. I hope the witnesses can provide testimony and opinions as to just how we, in Congress, can go about changing the Superfund.

My home of Dallas has experienced several Superfund problems, most notably in West Dallas, dealing with lead smelters.

Remediation technology is what I've requested of many companies because to move contaminated soil from one low income area to another is not the answer. So this is really central to the cleanup, is how we can improve the effort.

The EPA has done a credible job in its use of innovative technologies derived from R&D programs and I hope the witnesses today can comment on EPA's effectiveness as well as other areas of concern in the proposals to change the Superfund.

I thank you for being here. Thank you, Mr. Chairman.

Mr. ROHRABACHER. Ms. Johnson.

Mr. Minge, from Minnesota, do you have an opening statement?

Mr. MINGE. No, I do not have a statement. I look forward to hearing from the witnesses.

Mr. ROHRABACHER. Seeing that we have no other Republicans from our side, we'll just move right to the witnesses.

First, we have Dr. Huggett. If you have an opening statement that you can summarize we would appreciate it, but your statement will be made available for the record.

STATEMENT OF DR. ROBERT J. HUGGETT, ASSISTANT ADMINISTRATOR FOR RESEARCH & DEVELOPMENT, U.S. ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY E. TIMOTHY OPPELT, DIRECTOR, NATIONAL RISK MANAGEMENT RESEARCH LABORATORY, ORD

Dr. HUGGETT. Members of the Subcommittee, I am pleased to be here today to have this opportunity to describe the important research in which EPA's Office of Research and Development is performing.

I would like to have permission please to ask Mr. Tim Oppelt, who manages our laboratory that is most responsible for the Superfund research to join me at the table.

Mr. ROHRABACHER. Without objection, that would be fine.

Dr. HUGGETT. The cleanup of contaminated sites poses many complex technical problems. As you know, the nature, extent and degree of contamination and the resulting risk are often difficult to characterize. Cleanup techniques that are both inexpensive and effective are still not available for many difficult contamination problems.

ORD's Superfund Research strives to improve site characterization and risk assessment methods, and the cost-effectiveness of remediation technologies.

The scientific information and methods that this program has developed has resulted in communities being better protected and in remediation dollars being better spent.

EPA has maintained a comprehensive site remediation research program since CERCLA was enacted in 1980. In fiscal year 1995, as you just mentioned, the program was funded at approximately $60 million. That's only five percent of EPA's Superfund budget. This budget supports 146 scientists, engineers and supporting staff, as well as extramural and contractor dollars.

While most of our research is focused on site cleanup technologies we also conduct important research on site characterization, risk assessments and technical support to EPA's regional office and other site remediation managers. I would like to briefly describe each of these activities to set the stage.

Site characterization is approximately 10 percent of our budget but it is a significant part of the program. We can not conduct defensible and credible risk assessments and perform credible remediation without knowing the extent of contamination. We must understand the amount of contamination left after our cleanup and to ensure that our goals have been met.

The objective of our research in this area is to develop faster, simpler and more cost effective site characterization procedures and technologies. And to enable more realistic site specific exposure assessments by developing improved exposure models.

An example of this, for instance, is the development of portable field instruments where we can go directly to the site and on site

perform analysis of the physical environment and analyze samples on site, rather than sending them many miles away with all of the ensuing problems of contamination and time delay. This not only saves money, but it's better science.

Our research program is also making significant improvements in our ability to determine the potential for human and ecological exposure to site contaminants. Through this improvement in our understanding of how contaminants are transported we'll be better able to develop exposure models. Improved modeling will result in the identification of more realistic cleanup levels and reduce the chances that a cleanup is more stringent than needed, and this is very important.

We also conduct risk assessment research. And I understand and agree with the importance that you place with risk assessment. Risk assessments are critical and a critical component of remediation decision making. They're one of the principal tools that we must use to determine the level of cleanup that is going to be required as well as the risk associated with the cleanup activities. We have to make absolutely certain that the cure is not worse than the disease.

Realistic risk assessments will help the Agency answer the following key questions: who is at risk; what is the extent of the risk; and what contaminants and activities pose the greatest risk to the people exposed?

The goal of our risk assessment methods research is to reduce reliance on default assumptions by developing better data and better models. In other words, not using estimates of what exposures are but really trying to get the real numbers. For example, we have worked to replace linear dose-response models with more plausible biologically-based models. These advances will reduce uncertainty in our risk assessment to a considerable degree.

From the beginning, a key issue for Superfund research has been the availability, performance and the cost of remediation methods. Until the mid-1980s there were only a few conventional technologies available for site remediation, such as incineration or solidification of contaminated soils and pump and treat methods for ground water remediation. These approaches were often high cost and their effectiveness was difficult to predict.

Over the past 10 years ORD has significantly reduced the uncertainty and the cost associated with site remediation by evaluating, developing and demonstrating a wide variety of innovative remediation technologies. As a result, over 50 percent—over one half of the technologies being selected for site cleanup today are approaches which were not commonly used 10 years ago.

In 1995 remediation technology research represented nearly 40 percent of our Superfund research program. It is divided into three major components: The Superfund Innovative Technology Evaluation program, known as SITE—which you mentioned in your opening statement, Mr. Chairman—groundwater research; and bioremediation research.

The SITE program was developed in response to the Superfund Amendments and Reauthorization Act of 1986, commonly known as SARA. It directed EPA to establish a demonstration program for innovative technologies. The object of SITE is to increase the use

of already commercially developed technologies by producing credible performance data—and I underline "credible" there. It's extremely important to do this on full scale technologies applied to real world situations.

In this program, technology developers are responsible for developing the technology and operating the technology at a contaminated site. EPA's responsibility is to evaluate the technology performance, assure quality assurance and quality data, objectivity and to publish the test results. So, in effect, we are peer reviewers of the technology in this program.

The cost to demonstrate technology effectiveness are high. Site owners are often unwilling to pay for the tests. This makes it particularly difficult for small businesses, which make up the majority of innovative technology developers, to absorb the cost. In addition, many site owners or decision-makers are unwilling to take the risk of using this new technology even if conventional alternatives are more expensive.

The SITE program helps to address both of these problems by providing unbiased technology evaluation. The results can be used then by the vendor to add credibility in promoting the process.

The benefits of this program have been substantial. In the past nine years we have evaluated 112 innovative technologies. A recent assessment that was conducted in four of our regions that looked at 17 sites that utilized SITE technology found that the program had a cost savings of $358 million, as compared to using conventional technology. And, of course, those benefits will accrue in the future because they will be used more and more and more. In effect, this was a 62 percent savings, if you would like to have that number.

Another part of our remediation program is groundwater research. Groundwater is a principal risk pathway to humans. It's an extremely difficult area to work in. Many of the contaminants are in the form of non-aqueous phased liquids that either sit on top of the water table and contaminate from on top or they're on the bottom. Those are called NAPL and DNAPL—dense liquids underneath that have made pump and treat technologies—the conventional technologies—not as effective as we would like.

By the way, ORD researchers in our Superfund program were among the first to recognize these dense liquid phases in groundwater.

We're currently conducting field tests on several innovative technologies that will be alternatives to pump and treat. We're conducting a side by side comparison of nine different methods to clean up these dense, non-aqueous phase liquids.

We're conducting the first full scale field test of reactive subsurface walls to remediate chrome-plating operations. This technology puts a barrier of sand and iron filings in the path of the groundwater to convert the hazardous chromium to a non-hazardous phase.

In addition, we have bioremediation research in our site remediation. For a number of years we have realized that there's a great potential for bioremediation. It's a very cost effective way to clean up some types of waste. We've demonstrated a number of processes that are substantially cheaper than conventional approaches.

One of the major advances has been in understanding the intrinsic bioremediation, or natural attenuation. And we have nature help us in this cleanup. We found where there are situations where intrinsic bioremediation can be an effective cleanup; intrinsic bioremediation can reduce the cost of a cleanup in certain situations up to 90 percent. The focus of our research is to figure out and determine what types of contaminants and what geophysical properties of the soil and the groundwater are conducive—productive to the use of intrinsic bioremediation.

Mr. Chairman, I could go on with different types of research we're doing but I suspect perhaps that may come out in the questions.

I would just like to end by stating that one important aspect of our Superfund research is technical support. We have nationally recognized—internationally recognized scientists and engineers engaged in developing our research programs and conducting our research. One way to assure that this expertise is made available to site remediation is through a technical support program in which our experts are available to EPA's regional offices to provide site specific assistance. We provide advice directly to our regions. We provide advice to industry. We provide advice to the site owners. I think this is a part of our program that often goes unnoticed.

We have developed electronically accessible databases in this program. One is called the Ultimate Treatment Technology Information Center and we field more than 1,000 calls a month in this one database alone. We have an ORD Center for Groundwater Modeling Support and we support over 8,000 users annually in the United States and distribute over 2,000 copies of our groundwater models a year. So we have a great outreach program and this is very, very important.

In conclusion, we take pride in the accomplishments of our Superfund research program. We've helped reduce the uncertainties in calculating the public health and ecological risk associated with contamination. We've contributed to ensuring more cost effective site characterization and remediation technologies. And we are disseminating our knowledge to numerous public and private stakeholders.

I thank you again for this opportunity to address the Subcommittee and at the appropriate time I'll be happy to answer any questions that you may have.

Thank you, sir.

[The prepared statement of Dr. Huggett follows:]

PREPARED STATEMENT OF DR. ROBERT J. HUGGETT

ASSISTANT ADMINISTRATOR FOR RESEARCH & DEVELOPMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman and members of the Subcommittee, I am pleased to have the opportunity to describe the important research which EPA's Office of Research and Development (ORD) is performing to help reduce the uncertainties and the costs associated with Superfund site remediation. I am accompanied today by Mr. E. Timothy Oppelt, Director of ORD's National Risk Management Research Laboratory in Cincinnati. This Laboratory is responsible for a significant portion of our Superfund research. My testimony today will describe the components of EPA's Superfund research program, and highlight a number of our accomplishments.

Cleanup of contaminated sites poses many complex technical problems. The nature, extent and degree of contamination and resulting risks are often difficult to characterize. Cleanup techniques that are both inexpensive and effective are still not available for many difficult contamination problems. ORD's Superfund Research Program, an applied research program, strives to improve site characterization and risk assessment methods, and the cost effectiveness of remediation technologies. The scientific information and methods that this program has developed to date have resulted in communities being better protected and in remediation dollars being more wisely spent. It is critical for the success of the Superfund program to maintain a strong research program, including site characterization, and risk assessment, and site remediation research.

EPA has maintained a comprehensive site remediation research program since CERCLA was enacted in 1980. In Fiscal Year 1995, the program funding was approximately $60 million, 5% of EPA's Superfund budget; and 146 scientists, engineers and supporting staff were involved in this research and methods development.

There are three principal goals for site remediation research efforts:

1. identify and validate the performance of faster, lower cost site characterization and remediation methods,
2. improve health and ecological risk assessment methods and information, and
3. ensure that technically sound remediation information is available to the public, and to government and private sector decision-makers.

While most of our research program is focused on site cleanup technologies, we also conduct important research on site characterization and risk assessment, and provide technical support to EPA regional offices and other site remediation managers. I will briefly describe each of these activities and provide examples of major benefits that they provide.

Site Characterization Research

Site characterization is a small (approximately 10%) but significant part of our Superfund research program. We cannot conduct defensible and credible risk assessments or determine how to remediate sites unless we know the nature, extent and degree of site contamination. We must also understand the amount of contamination left at sites after cleanup to ensure our cleanup goals have been met. Site characterization can be an expensive and time-consuming endeavor, ranging from tens of thousands to over a million dollars, depending on site complexity.

The objective of ORD's site characterization research is to: 1) develop simpler, faster, and more cost-effective site characterization procedures and technologies, and 2) enable more realistic, site-specific exposure assessments by developing improved exposure models. An example of important progress in this area is the field-portable instruments which we are developing to allow us to characterize the physical environment and analyze samples right at the site that reduce analysis time from days or weeks to hours. In addition, we have developed improved sampling procedures and designs which allow site managers to collect preliminary data, model these data, and then determine where additional characterization data are needed, all in a matter of hours. The result is a more accurate and rapid characterization of a site which lowers costs and improves site remediation decisions. At one Missouri site contaminated with dioxins the use of improved sampling designs saved approximately $6 million in cleanup costs because of our ability to more quickly and accurately define the areas that needed to be cleaned up.

Our research program is also making significant improvements in our ability to more realistically determine the potential for human and ecological exposure to site contaminants. Through improvements in our understanding of how contaminants are transported in the environment we have been able to develop more realistic exposure models. Improved modeling should result in the identification of more realistic cleanup levels and reduce the chances that a cleanup is more stringent than it need be to protect health and the environment, with resultant unnecessary costs to the government or the PRP.

Risk Assessment Research

Risk assessments are a critical component of remediation decision-making. They are one of the principal tools used to determine the level of cleanup that will be required, as well as the risks associated with the cleanup activities. Therefore it is essential that they are reasonable, consistent and grounded in reality. Realistic risk assessments help the Agency answer the following key questions at complex sites: who is at risk; what is the extent of the risk; and what contaminants and activities pose the greatest risks to those exposed. The objectives of ORD's risk assessment research activities are to:

1. develop methodologies for more realistic estimates of risk,

2. develop better risk assessment tools and databases for private sector, government and community risk assessors, and
3. provide site-specific technical assistance to risk assessors.

The goal of ORD's methods research is to reduce reliance on default assumptions by developing better data, methods and models. For example, we have improved understanding of the health and ecological effects of ubiquitous and highly toxic contaminants such as polycyclic aromatic hydrocarbons (PAHs), dioxins, lead and solvents; and have worked to replace linear dose-response models with more plausible biologically-based models. Both of these advances will reduce uncertainties in Superfund site risk assessments.

ORD's risk assessment research program is also developing better tools and data bases to facilitate stakeholder involvement in community-based risk assessments. For example, ORD recently released an Exposure Factors Handbook which provides a summary and evaluation of the key assumptions and factors used in risk assessments. ORD has developed a Windows-based expert software system called Risk*Assistant which allows assessors to quickly and consistently conduct preliminary risk assessments. The Agency has also developed an ecotoxicology database (ECOTOX), which is used by EPA Regional and Program Office staff and other Federal, State and regulatory scientists undertaking ecological risk assessments.

ORD's risk assessment program also provides technical assistance to the Superfund Program to link site assessors to risk assessment experts. Examples of these activities include facilitating technical meetings on complex risk assessment issues with site owners, providing quick turn-around expert consultation, and serving as expert witnesses on nationally-significant enforcement cases.

Site Remediation Research

From the beginning, a key issue for the Superfund Program has been the availability, performance, and cost of remediation methods. Until the mid-1980s there were only a few conventional technologies available for site remediation, such as incineration or solidification of contaminated soils and pump-and-treat methods for groundwater remediation. These approaches were often high-cost or their effectiveness was difficult to predict.

Over the past ten years, ORD has significantly reduced the uncertainty and cost associated with site remediation by evaluating, developing, and demonstrating a wide variety of innovative remediation technologies. As a result of these research efforts and a variety of EPA cleanup policy initiatives, over 50% of the technologies being selected for site cleanup today are approaches which were not commonly in use ten years ago.

In 1995, remediation technology research represents nearly 40% of our Superfund research program. It is divided into three major components: the Superfund Innovative Technology Program (SITE), groundwater research, and bioremediation research.

SITE—The SITE Program was developed in response to the Superfund Amendments and Reauthorization Act of 1986 (SARA), which directed EPA to establish a demonstration program for innovative remediation technologies. The objective of the SITE program is to increase the use of commercially developed technologies by producing credible performance data on full-scale technologies applied in real world situations. In this program, technology developers are responsible for deployment and operation of their technology at a contaminated site, while EPA is responsible for evaluating technology performance, assuring data quality and objectivity, and publishing the test results.

The need for a Federal SITE program exists because of the high financial and technology performance risks associated with site remediation. Many remediation technologies are mobile and require large capital investments and expert operators. Consequently, the cost to demonstrate a unit's effectiveness is high. Site owners are often unwilling to pay for these tests and therefore the technology developer must bear these costs with no guarantees of obtaining a cleanup job. This makes it particularly difficult for small businesses, which make up the majority of innovative technology developers, to absorb these costs. In addition, many site owners or decision-makers are unwilling to take the risk of using an innovative technology, even if the conventional alternative is more expensive, because they do not want to be exposed to potential delays, performance uncertainties, and cost overruns from an "untried" process.

SITE helps to address both of these problems by providing unbiased technology evaluations. The resulting reports can be used by vendors to add credibility in promoting their processes, and by site owners or government decision-makers to select remediation options.

The benefits of SITE have been substantial. In the past nine years, we have evaluated 112 innovative technologies, one quarter of which were at Federal facilities. A recent assessment conducted of cleanup decisions at 17 sites that employed the types of technologies tested in the SITE Program showed a total cost savings of $358 million, compared to conventional technologies being considered for those sites. This represents an average savings of $21 million per site, a 62% savings from the cost of the conventional technology. SITE Program technology developers have also been selected for over 500 cleanup jobs in the U.S. to date.

Groundwater Remediation—Groundwater provides a principal risk pathway and is the limiting factor for complete site remediation at the majority of Superfund sites. The lack of effective groundwater remediation technologies is one reason for the high cost and slow pace of remediation at many NPL sites. Pump-and-treat, the most widely used groundwater cleanup technique, is inefficient and commonly takes years to achieve cleanup. More effective, less costly and faster subsurface remediation technologies will speed the rate at which any risk from subsurface contamination to drinking water and the environment can be adequately reduced.

ORD's groundwater research has focused on understanding the behavior of contaminants in the subsurface and developing processes to more cost-effectively destroy them or extract them from the environment. ORD researchers were among the first to recognize that subsurface pools of undissolved contaminants (non-aqueous phase liquids or NAPLs) were one of the principal reasons for the failure of early attempts to clean up contaminated groundwater. This recognition led to major changes in the way that groundwater remediation risk assessments and cost estimates are made in the Superfund program. It also contributed to the establishment of the "technical impracticability waiver" policy for sites where no practicable remediation alternative is available. This policy allows for the use of an intermediate alternative to limit risk, pending eventual development of a more effective technology.

ORD researchers are currently conducting field tests on several innovative technologies which will be among the first subsurface treatment alternatives to pump-and treat. For instance, we are conducting a side-by-side comparison of nine enhanced source removal technologies to clean up residual NAPLs which are acting as sources of contamination at Hill Air Force Base, Utah. The research team was the first to demonstrate the adaptation and application of the partitioning tracer technique (adapted from the petroleum industry) to locate and measure the amount of residual NAPL at the test site and the effectiveness of the remediation. This technique looks very promising and should be cheaper than collecting soil core samples or installing monitoring wells.

ORD researchers are also conducting the first full-scale field test of the use of a reactive subsurface wall to effect in-place remediation of groundwater contaminated from a chrome-plating operation at a US Coast Guard site in North Carolina. This technology involves placing a permeable subsurface zone of sand and iron filings in the path of the flowing groundwater. Contaminants react with the iron and are converted to a non-hazardous and immobile form. Full-scale application of this highly effective technology could save approximately $3 million in cleanup costs at this site. Given the large number of sites in the U.S. where similar application of this approach is possible, the total cost savings are potentially in the range of tens to hundreds of millions of dollars.

Bioremediation—For a number of years scientists have realized that there is a potential for bioremediation to be a very cost effective means of remediation. In 1987, EPA launched a program to develop promising bioremediation technologies. Since then we have demonstrated a number of processes which are substantially cheaper than conventional approaches. Much of this work has been carried out in collaboration with other Federal agencies, industry and academia.

One major advancement has been in understanding intrinsic bioremediation, or natural attenuation. We have found that there are situations where intrinsic bioremediation can be an effective means of site cleanup, if it is accompanied by appropriate monitoring to insure actual degradation and control of the contaminants. We have demonstrated its effectiveness on soils contaminated with fuel spills and with hazardous chlorinated hydrocarbons. Intrinsic bioremediation can reduce the cost of conventional groundwater remediation by up to 90%. The major focus of our research is to determine what types of contaminant and geophysical properties of sites are conducive to the use and predictability of performance of intrinsic bioremediation.

EPA is also one of the pioneers in bioventing technology, an in-place remediation process that delivers oxygen to the subsurface to support the microorganisms that degrade contaminants. EPA conducted the first field studies of injection bioventing, demonstrating its effectiveness on soils contaminated by fuel spills. Bioventing can

save 80% of the cost of soil cleanup with conventional technology. As a result, this technology has been selected for use at over 1,000 contaminated sites in the U.S.

Technical Support

ORD has nationally-recognized scientists and engineers engaged in developing the innovative techniques and technologies described above. One way we assure that this expertise is directly utilized in site remediation is through a technical support program in which technical experts are available to EPA's Regional Offices to provide site-specific assistance. The benefits of a strong Federal technical support program are numerous. Our experts' advice represents the most recent advances in research and development. By serving as the technical consultants to EPA's Remedial Project Managers (RPMs) and On-Site Coordinators (OSCs) we help to promote consistency in remediation decisions nationally, and we help to improve the timeliness, technical quality and cost-effectiveness of those decisions. Our technology transfer activities help to encourage cost-effective application of traditional and emerging technologies by both public and private sector decision-makers. These technology transfer activities reach beyond the Superfund Program, providing support to remediation actions at the State level and for private sites.

ORD annually provides direct technical support to over 200 sites that are on the National Priority List (NPL). In addition, we publish engineering design guides and conduct workshops and training courses to transfer research results to public and private sector remediation professionals. Electronically accessible databases, such as the Alternative Treatment Technology Information Center which fields over 1,000 calls per month, are also an important technical support vehicle. ORD's Center for Groundwater Modeling Support provides groundwater modeling support to over 8,000 users annually, and distributes over 2,000 copies of groundwater models each year.

Our objective of assisting in selecting better, faster and cheaper remedies has been met in a number of remarkable cases. At a wood preserver site in Louisiana, we conducted fast-tracked technology evaluations leading to accelerated selection of a remediation option. This cut months off the cleanup schedule. Thorough data analysis and interpretation of groundwater contamination at a site in California provided the technical basis to halt plans for a $25 million water treatment system without risk to drinking water quality. Modeling of contaminant transport at a site in New York showed that the cheaper treatment process was equally effective, saving $2 million.

Future Research Directions

While much progress has been made in reducing the technical uncertainties and cleanup costs of remediation, a number of technical issues remain.

We need to continue to make site-specific risk assessments more realistic. This will require specific improvements in the methods and scientific data used to assess the potential for human and ecosystem exposure to contaminants at Superfund sites. Our efforts will concentrate on adopting advances in effects and exposure methodology from other research in EPA and other Federal research programs into user-friendly tools that can be effectively used by risk assessors at the State and community level. In addition, research will seek to develop health and ecological assay techniques for establishing alternative cleanup goals for site contamination. These techniques may offer more meaningful measures of actual site risk than the chemical-specific risk assessments employed today.

Site characterization research must continue to strive to develop less expensive and more rapid techniques. We will continue to expand the applicability of on-site field analytical technologies to a broader range of contaminant types. Also, the development of a new generation of geophysical technologies based on 3-D-data acquisition (as pioneered by the petroleum industry) and analysis will allow site managers to more accurately and quickly determine the location of subsurface contaminants.

Remediation technology research will place emphasis on the development and evaluation of "in place" treatment technologies for contaminated soils and groundwater. These approaches promise to significantly reduce cleanup costs if their performance can be verified and methods developed to reliably predict performance in field situations. This information continues to be a critical factor in technology acceptance and use by public and private sector decision-makers.

Finally, we will continue to emphasize a strong program in technical assistance and technology transfer of our research results to State and regional decision-makers. The availability of high quality, state-of-the-science technical information is critical to assuring cleanup decisions which protect public health and the environment at reasonable cost.

Conclusion

In conclusion, we take pride in the accomplishments of our Superfund Research Program. We have helped to reduce the uncertainties in calculating the public health and ecological risks associated with contaminated sites. We have contributed to insuring that more cost-effective site characterization and remediation technologies are available in the marketplace. And we are disseminating our knowledge to the numerous public and private stakeholders in Superfund, thus advancing their ability to remediate contaminated sites in the most beneficial and cost-effective manner. I thank you again for the opportunity to address this Subcommittee, and I am happy to answer any questions that you may have.

Mr. ROHRABACHER. Dr. Huggett, thank you very much.

I'm very impressed with your testimony today and I appreciate your coming here. Actually, you said some things that were very inspiring.

Mr. Dyckman.

STATEMENT OF LAWRENCE J. DYCKMAN, ASSOCIATE DIRECTOR, ENVIRONMENTAL PROTECTION ISSUES, RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION, U.S. GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY PAUL SCHMIDT, SENIOR EVALUATOR

Mr. DYCKMAN. Thank you, Mr. Chairman, Members of the subcommittee.

My name is Larry Dyckman. I'm with the U.S. General Accounting Office. I'm an associate director. With me today is Paul Schmidt, who is a senior evaluator in our Chicago regional office. I'll summarize my statement.

We are pleased to have the opportunity to participate in the subcommittee's discussions on the future of Superfund research and development activities.

Superfund reauthorization may bring major changes in many areas such as how sites are cleaned up and how responsibility is divided between the federal and state governments. These changes, in turn, may call for modifications to the Superfund research and development effort.

In past and ongoing work we have assessed an important component of this effort—EPA's attempt to promote the use of innovative technologies at Superfund sites. We found that EPA has made progress in the use of innovative technologies. In 1994 EPA used technologies in about 20 percent of its cleanup decisions and Superfund sites.

Our work also identified four types of barriers that currently inhibit the further development and routine use of innovative technologies for cleaning up hazardous waste sites.

I'd like now to briefly discuss some of these barriers.

The first involves regulatory standards. Innovative technologies have difficulty meeting the regulatory cleanup standards at many of the Superfund sites.

For example, for the treatment of PCBs, EPA has set standards derived from its toxic substances regulations which are based in part on the performance of incinerators.

Innovative technologies generally have been unable to meet cleanup standards for PCBs.

As you know, the House and Senate Superfund reauthorization proposals currently being considered would reduce the number of federal and state requirements potentially applicable to Superfund cleanups.

If passed, these proposals might make it easier for innovative technologies to meet cleanup standards.

A second barrier involves technical considerations. Innovative technologies are, by definition, at their early stages of development, and still face technical barriers to their use. These technologies may only be applicable to certain sites, certain conditions at sites, and certain types of contamination.

For example, these technologies are not generally suited for cleaning up sites with highly contaminant toxic substances, large amounts of contaminated materials or multiple contaminants.

More traditional cleanup technologies, such as incineration, are generally effective over a wide range of conditions, although they might be more expensive.

A third barrier involves limited cost and performance information. Innovative technologies have generally not gone through full scale application at Superfund sites.

Therefore, data on their performance, cost, and suitability under various site conditions are generally not yet available. Technologies must in fact be used multiple times under a variety of conditions before their cost and performance data become reliable and acceptable for cleanup decisionmaking purposes.

Because the information necessary to make cleanup decisions is not readily available, EPA and private industry officials responsible for cleaning up Superfund sites have been reluctant to choose innovative technologies. To overcome this reluctance, in 1992, the EPA entered into a cooperative agreement with Clean Sites, a not-for-profit organization to demonstrate full scale application of innovative technologies at several federal facilities.

Seven demonstrations are currently underway. However, we do not have outcome data on these demonstrations.

The fourth barrier involves a lack of incentives to invest in innovative technologies. Uncertainty about both the market for site cleanups for certain types of contamination and future regulatory cleanup standards also create a disincentive for private industry to invest in innovative technologies.

Also, House and Senate reauthorization bills would eliminate the current law's preference for permanent cleanup remedies, that is, remedies which eliminate contaminants rather than merely containing them on site.

Since innovative technologies often are intended to provide permanent remedies, this change could in fact add additional uncertainty about the strength of the future market for new technologies.

EPA's main program for removing barriers using innovative technologies at Superfund sites is the Superfund Innovative Technology, or SITE program. On their site, EPA enters into cooperative agreements with private technology developers who, after refining their technologies at small scale, may demonstrate them with support from EPA, at Superfund sites.

SITE then publishes information on the performance of the technologies during their demonstration.

However, in our on-going work, we found that SITE's reports have a tendency to concentrate on the science of innovative technologies and provide only limited information on the actual implementation problems encountered while using these technologies at full scale Superfund sites.

SITE officials we spoke with acknowledged this problem.

In short, Mr. Chairman, we believe that EPA has in fact made progress over the years in using innovative technologies at Superfund sites.

However, these technologies are still used at only a relatively small portion of the sites. As we said earlier, only 20 percent of the record of decisions actually use innovative technologies.

Ready use of new technologies which can reduce the cost of cleanups has been prevented by various obstacles which I mentioned earlier. Even after the Congress reauthorizes Superfund, it is likely that these challenges to the development and use of new technologies will continue.

Mr. Chairman, I appreciate the opportunity to testify today and I would be happy to answer any questions you or Members might have.

[The prepared statement of Mr. Dyckman follows:]

PREPARED STATEMENT OF LAWRENCE J. DYCKMAN, ASSOCIATE DIRECTOR, ENVIRONMENTAL PROTECTION ISSUES, RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION, UNITED STATES GENERAL ACCOUNTING OFFICE

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to participate in the Subcommittee's discussions of Superfund research and development activities, such as developing more efficient ways for cleaning up Superfund sites. The Subcommittee is reconsidering the scope and direction of these activities in view of the ongoing debate on Superfund's reauthorization. Reauthorization may bring major changes to Superfund in such areas as how sites are cleaned up and responsibility is divided between the federal and state governments. These changes, in turn, may call for modifications to Superfund's research and development effort. In past and ongoing work, we have assessed an important component of this effort—the Environmental Protection Agency's (EPA) attempts to promote the use of innovative technologies at Superfund sites.[1] We believe that the findings of our work are relevant to the Subcommittee's effort to guide the future direction of Superfund's research and development.

In response to your request, our testimony today focuses on three areas: (1) how often EPA uses innovative technologies at Superfund sites, (2) what factors limit the use of innovative technologies, and (3) how EPA's Superfund Innovative Technology Evaluation program encourages the development and use of innovative technologies at Superfund sites.

In summary, we found the following:

—EPA used innovative technologies in about 20 percent of its cleanup decisions made during 1994 at Superfund sites. (See app. I for a description of innovative technologies used at Superfund sites.) A recent EPA study also showed that the various parties that could be responsible for the cleanups, such as EPA, other federal agencies, or private parties, were as likely to select innovative technologies.[2]

—A number of barriers currently inhibit the further development and routine use of innovative technologies at Superfund sites. These barriers include the need to meet difficult regulatory standards, technical limitations, limited cost and perform-

[1] EPA considers a technology to be innovative if it has not been used in a full-scale application or if it is the first-time application of an existing technology to a new contaminant. More specifically, EPA defines innovative treatment technologies as those that lack the cost and performance data necessary to support their routine use.

[2] *Feasibility Study Analysis, Volume 1: Findings and Analysis,* prepared for the Technology Innovation Office by Environmental Management Support, Inc. (Silver Spring, Md., Apr. 21, 1995).

ance data, and the lack of incentives to invest in the development of innovative technologies.

—EPA's primary program for encouraging the development and use of innovative technologies at Superfund sites is the Superfund Innovative Technology Evaluation (SITE) program. EPA's SITE program is intended to remove the barriers that innovative technologies face. Located within EPA's Office of Research and Development, the SITE program is a major part of EPA's research into innovative cleanup methods for Superfund sites. SITE's primary functions include testing unproven technologies at Superfund sites and publishing information on the performance of new technologies.

BACKGROUND

Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), which created the Superfund program, EPA assesses hazardous waste sites and places the most seriously contaminated ones on its National Priorities List (NPL). CERCLA makes certain parties, including those who contaminated the sites, responsible for cleaning them up, but it also established a trust fund to pay for cleanups when the parties cannot or will not pay. Since CERCLA's enactment in 1980, EPA has placed nearly 1,300 sites on the NPL.

The Superfund Amendments and Reauthorization Act of 1986 (SARA) required EPA to establish a research and development program for innovative treatment technologies. EPA's Superfund research and development is focused on four main research topics: (1) improving Superfund risk assessments; (2) making other site studies more accurate, faster, and less expensive; (3) performing research into cleanup technologies; and (4) providing better technical support.

In addition to its research and development efforts, EPA makes other efforts to increase the use of innovative technologies at Superfund sites. For example, the Technology Innovation Office acts as a clearinghouse for information on innovative cleanup technologies. Furthermore, EPA has also issued guidance that encourages its regional offices to consider innovative technologies for cleaning up Superfund sites.

EPA'S USE OF INNOVATIVE TECHNOLOGIES

EPA selected an innovative technology in about 20 percent of all the cleanup decisions made in 1994—up from 6 percent in 1986. The most commonly used of these new technologies are soil vapor extraction, which flushes contaminants into the air for further treatment, and bioremediation, which uses microorganisms to break down the contaminants into less harmful forms. Nine years ago, innovative technologies were rarely used at Superfund sites; since then, they have been selected over 290 times. (See app. II for a table of innovative technologies by fiscal year.)

A recent EPA study also showed that the various parties that could be responsible for the cleanups, such as EPA, other federal agencies, or private parties, were as likely to select innovative technologies. However, no matter which organization is leading the cleanup effort, a number of barriers exist to the wide-spread use of innovative technologies at Superfund sites.

BARRIERS TO THE USE OF INNOVATIVE TECHNOLOGIES

Several factors, often inherent in any unproven technology, have inhibited the further development and widespread use of innovative technologies at Superfund sites. These factors include (1) regulatory standards, (2) technical limitations of innovative technologies, (3) lack of sufficient cost and performance data, and (4) lack of incentives for private industry to invest in innovative technologies.

Regulatory Standards

Innovative technologies have difficulty in meeting the regulatory cleanup standards at many Superfund sites. For example, for the treatment of Polychlorinated Biphenyls (PCBs), EPA sets standards, derived from its toxic substances regulations, that are based in part on the performance of incinerators. Innovative technologies generally have been unable to meet these standards at PCB-contaminated Superfund sites. Recognizing this barrier, EPA recently proposed amendments to its toxic substances regulations to allow more flexibility in the cleanup standards for PCBs. Specifically, the proposal would allow, in addition to performance-based standards, other types of standards, including health-based ones, that may be potentially easier for innovative technologies to meet.

The House and Senate reauthorization proposals for Superfund, which are currently being considered would reduce the number of federal and state requirements potentially applicable to Superfund cleanups. If these proposals passed, innovative technologies would in some cases need to meet fewer cleanup standards.

Technical Barriers

Innovative technologies are, by definition, at their early stages of development and may only be applicable to certain site conditions or specific types of contamination. For example, these technologies are generally not yet suited for cleaning up sites with highly toxic contaminants (such as PCBs or dioxin), large amounts of contaminated materials, high concentrations of a contaminant, or multiple contaminants. In addition, their performance can vary depending on the physical and chemical characteristics of the contaminated material, such as moisture levels, clay and silt content, and the presence of other chemical substances. On the other hand, more traditional cleanup technologies, such as incineration, are generally effective over a wide range of conditions.

Limited Cost and Performance Information

Innovative technologies have generally not gone through full-scale application at Superfund sites. Therefore, data on their cost, performance, and suitability under various site conditions are generally not available. EPA officials believe that technologies must be used multiple times under a variety of conditions before their cost and performance data become reliable and acceptable for cleanup decision-making purposes.

Because the information necessary to make cleanup decisions is not readily available, EPA and private industry officials responsible for cleaning up Superfund sites have been reluctant to choose unproven innovative technologies. To overcome this reluctance, EPA entered into a cooperative agreement with Clean Sites[3] in 1992 to demonstrate full-scale applications of innovative technologies at several federal facilities. The goal of the agreement is to demonstrate innovative technologies at real sites in order to generate actual performance data. Seven demonstrations are currently under way; however, data are not yet available on their outcome.

Lack of Incentives to Invest in Innovative Technologies

Uncertainty about both the market for site cleanups for certain types of contamination and future regulatory cleanup standards also create a disincentive for private industry to invest in innovative technologies. For example, the production of PCBs stopped in 1977, and the number of sites known to be contaminated with dioxin is relatively small. Also, House and Senate reauthorization bills would eliminate the current law's preference for permanent cleanup remedies, that is, remedies that eliminate contaminants rather than merely containing them onsite. Since innovative technologies often are intended to provide permanent remedies, this change could add additional uncertainty about the strength of the future market for new technologies. Furthermore, because the promulgation of a new environmental standard often takes many years, investors often choose to wait rather than invest in innovative technologies. They worry that if they invest money in a new technology, by the time the new standards come into effect, the technology might be obsolete.

EPA'S SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION PROGRAM

Under the SITE program, EPA enters into cooperative agreements with private technology developers who, after refining their technologies on a small scale, may demonstrate them, with support from EPA, at Superfund sites. In fiscal year 1995, SITE spent about $12 million to demonstrate 11 technologies. SITE's budget for demonstrations represented about 20 percent of Superfund's entire research and development budget and about 50 percent of EPA's budget for Superfund cleanup technology research.

SITE has four components. The Demonstration Program publishes data on the cost, performance, reliability, and applicability of selected innovative technologies after field demonstrations are conducted. The Emerging Technologies Program provides financial assistance to developers of new technologies undergoing laboratory

[3] Clean Sites is a nonprofit corporation whose mission is to improve the cleanup of hazardous waste sites.

tests. The Monitoring and Measurement Technologies Program tests new technologies to assess the nature and extent of contamination at sites. The Technology Transfer Program disseminates information derived from the other three SITE components to interested parties.

SITE solicits technologies for inclusion in the program through annual requests for proposals. The criteria that SITE uses to select technologies for demonstration include the technology's potential for reducing contamination, the technical viability of the technology, and the technology developer's potential for commercializing the technology. We said in our testimony of April 1993,[4] that SITE did not target its solicitations in an attempt to address any specific technology needs. However, in our current review we noted that the January 1995 SITE solicitation for proposals generally did advise technology developers of EPA' s particular interest in innovative technologies for cleaning up specific types of contaminants.

Superfund officials involved in cleaning up sites told us that SITE's demonstrations often focus on the science of the innovative technologies and thus provide only limited information describing potential implementation problems at actual Superfund sites. For example, the EPA site manager at Times Beach (Missouri) told us that SITE had initially been extremely positive about the scientific potential for using one of its demonstrated technologies at Times Beach. However, after learning the specific site characteristics, such as the large volume and types of contaminated material, SITE officials conceded that the technology was inappropriate.

Superfund program officials told us that they began to work with SITE in 1993 to make its information more useful. As a result, additional information has been added to SITE's technology demonstration reports. However, SITE program officials told us that time and resource constraints will always limit the amount of information they can provide.

In summary, we believe that EPA has made progress over the years in using innovative technology at Superfund sites. However, these technologies are still used at only a relatively small portion of the sites. Greater use of new technologies, which can reduce the cost of cleanups, has been prevented by various factors such as regulatory standards, the absence of track records for these technologies, and uncertainties about future regulatory standards. Even after the Congress reauthorizes Superfund, it is likely that these challenges to the development and use of new technologies will continue.

Mr. Chairman, this concludes our prepared statement. We will be glad to respond to any questions that you or members of the Subcommittee may have.

APPENDIX I

TYPES OF INNOVATIVE TECHNOLOGIES USED BY EPA

Dechlorination results in the removal or replacement of chlorine atoms bonded to hazardous compounds. EPA has selected dechlorination to treat polychlorinated biphenyls (PCBs), dioxins, pesticides, and semivolatile organic compounds (SVOC).

Ex-situ bioremediation is a technology that uses microorganisms to degrade organic contaminants on excavated soil, sludge, and solid wastes. The microorganisms use the contaminants for food, thus breaking them down; the end products are typically carbon dioxide and water. Ex-situ bioremediation includes slurry-phase bioremediation, in which the soils are mixed with water to form a slurry, and solid-phase bioremediation, in which the soils are placed in a tank or building and cultivated with water and nutrients. EPA has selected bioremediation to treat volatile organic compounds (VOC), SVOCs, and polycyclic aromatic hydrocarbons (PAH).

In-situ bioremediation involves pumping nutrients, an oxygen source, and sometimes microbes into the soil or aquifer under pressure through wells or spreading them on the surface for infiltration to the contaminated material. The microorganisms present in the soil then degrade the contaminants as in ex-situ bioremediation.

In-situ flushing introduces large volumes of water, at times supplemented with treatment compounds, into the soil, waste, or groundwater to flush hazardous contaminants from a site. This technology assumes that injected water can be effec-

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[4] *Superfund: EPA Needs to Better Focus Cleanup Technology Development* (GAO/T-RCED-93-34, Apr. 28, 1993).

tively isolated within an aquifer and recovered. EPA has selected this technology to treat VOCs, metals, SVOCs, and PAHs.

In-situ vitrification treats contaminated soil in place at temperatures of approximately 3,000 degrees Fahrenheit. Metals are encapsulated in a glass-like structure of melted silicate compounds. Organic wastes may be treated by combustion. EPA has selected the remedy to treat metals, pesticides, VOCs, and SVOCs.

Soil vapor extraction removes volatile organic constituents from the soil by using vapor extraction wells, sometimes combined with air injection wells, to strip and flush the contaminants into the air stream for further treatment. Vacuum extraction has been selected to treat halogenated and nonhalogenated VOCs, benzene, toluene, ethylbenzene, xylene, and SVOCs.

Soil washing physically removes contaminants from soil particles through mechanical action and washing with water (sometimes using additives). The agitation of the soil particles allows the smaller-diameter, more highly contaminated fine particles to separate from the larger soil particles, thus reducing the volume of material that needs subsequent treatment. EPA has selected this remedy to treat metals, PAHS, dioxins, pesticides, and SVOCs .

Solvent extraction is a process that operates on the principle that organic contaminants can be separately dissolved and removed from the waste in a solvent. The solvent used varies depending on the waste to be treated. EPA has selected this remedy to treat PCBs, VOCs, PAHs, dioxins, and SVOCs.

Thermal desorption is a process that heats waste in a controlled environment to cause organic compounds to volatilize from the waste. The operating temperature is less than 1,000 degrees Fahrenheit. The volatilized contaminants will usually require further control or treatment. The contaminants most often treated with thermal desorption include VOCs, PCBs, SVOCs, pesticides, and metals.

APPENDIX II

Number of Cleanup Actions (Remedial and Removal) for which Each Type of Innovative Technology Was Selected, by Fiscal Year

	Fiscal year of record of decision									
Technology[a]	1986	1987	1988	1989	1990	1991	1992	1993	1994	Total
Ex-situ bioremediation	1	0	4	7	4	4	8	6	5	39
In-situ bioremediation	0	1	2	0	3	3	4	7	5	25
Dechlorination	0	0	0	0	1	2	0	0	0	3
In-situ flushing	1	0	1	3	1	3	4	2	3	18
In-situ vitrification	0	0	0	0	0	1	0	0	0	1
Soil washing	0	0	2	2	6	1	1	0	0	12
Solvent extraction	0	0	0	3	0	1	0	1	1	6
Thermal desorption	1	3	4	2	8	10	5	10	7	50
Soil vapor extraction	2	1	7	22	17	33	18	22	11	133
Other technologies	0	0	0	0	0	1	2	0	1	4
Total	5	5	20	39	40	59	42	48	33	291

Note: While in absolute numbers the cleanup actions for which an innovative technology was selected declined after 1991, they have increased as percentage of total treatment technologies since 1986.

[a] For technology definitions, see app. I.

Mr. ROHRABACHER. Thank you very much, Mr. Dyckman.

I am going to do something, with the permission of my fellow Members, that is a little bit different than usually happens at these hearings.

I would like to ask you if you have any questions that you would like to ask Dr. Huggett which emerge from your report.

Mr. DYCKMAN. Well, Dr. Huggett and I met the other day to discuss some of the issues involved. We had a very fruitful and interesting conversation.

Obviously central to this entire discussion, and I guess to the hearing today, is the usefulness of site and whether or not these new technologies that are needed for more effective and less expensive cleanups, especially at federal facilities, whether they would in

fact be developed and come to the market without the aid of federal intervention, without federal taxpayers' dollars being spent for example in the SITE Program.

So that gets at the essence of it. Is there a need for the Federal Government to have a direct role in demonstrating these technologies? Or are there technologies that are entering the marketplace without going through the site program? Does that cause us to believe that maybe EPA does not have to spend money on those demonstrations?

Mr. ROHRABACHER. Why do we not throw that to Dr. Huggett right now——

Mr. DYCKMAN. But this is somewhat irregular because I usually do not do this.

Mr. ROHRABACHER. Well that is the way I run things around here.

Mr. DYCKMAN. That is why you are the Chairman.

[Laughter.]

Mr. ROHRABACHER. That is right.

Dr. Huggett, why do you not proceed. I think that is a very good, fundamental first question.

Dr. HUGGETT. Yes, I believe it is. The basic question of whether or not innovative technology would happen, innovative technologies for cleanups without the intervention of EPA, I think the answer is, by and large, no.

It is so because there is no way right now to give credibility to ensure that the performance data that are purported by the developer is actually true.

It is part of peer review; it is part of quality assurance.

Now I would admit and concede that large companies, multi-billion dollar companies, have the money to test and go out and get an independent appraisal of their technology. However, 47 percent of the sales of innovative technology, the vendors, 47 percent basically have sales under $5 million.

By and large, these are small companies. They are not the huge corporations that we think of and these people do not have the capital to do this.

So it is credibility; it is availability of capital that I think would limit the spontaneous, if you will, development, or directed development of innovative technologies for Superfund.

Mr. ROHRABACHER. What about regulatory barriers? Is there not some danger there that basically the government may be getting more in the way than helping out?

Dr. HUGGETT. Well, Mr. Dyckman mentioned this in his testimony, and I believe that there is some truth to what he says. I think that, as he did mention, some of the more recent things that we are doing with Superfund are relaxing some of those, and I think we are well on our way to removing those barriers.

Mr. ROHRABACHER. I will give you one more shot, Mr. Dyckman. Go right ahead. Do you have another question?

Mr. DYCKMAN. I guess you are pressing me.

[Laughter.]

Mr. DYCKMAN. Another obvious question, as a taxpayer and as a government auditor, is you try to look to avoid duplication of effort. One cannot fail to see the fact that, for example, the Depart-

ment of Energy's Innovative Technology Program dwarfs EPA's program by probably a twenty-fold magnitude.

They spend upwards of $500 million a year on innovative technologies, and we have done reviews of that program. While we have found fault with it, we have also noticed that some of the same things that EPA's SITE Program does basically demonstrates technologies that the DOE program also does.

So I guess I would suggest——

Mr. ROHRABACHER. Is there some duplication here?

Mr. DYCKMAN. Right. Is there a need for consolidation of programs to possibly one federal innovative technology effort?

So that would be maybe a question I would pose.

Dr. HUGGETT. This is another good statement by Mr. Dyckman. We do not do our work in Superfund in a vacuum. We are working actively with DOD and DOE to minimize redundancy and to actually get synergism in our work.

DOD and DOE have many very unique problems.

Mr. ROHRABACHER. Dr. Huggett, would you give us an example of that where you are working on one end of a program in EPA, and then the Department of Energy has another end?

Dr. HUGGETT. We are working with DOE at Rocky Flats, Colorado. We are working with DOE at Savannah River. We are working with DOD at the North Island Naval Base in San Diego and McClellan Air Force Base near Sacramento, areas that I am sure you are very familiar with.

We participate in discussions to develop these technologies. We are learning from each other. We do have many common problems. In other words—

Mr. ROHRABACHER. So instead of duplication, you are saying that often what appears to be duplication might be cooperation?

Dr. HUGGETT. Yes, sir.

Mr. ROHRABACHER. Okay, well that is a good answer.

I would like to ask you a question of my own, if I can. I am going to use an example here. By the way, this is not a setup. I had no idea this fellow was going to be here today, but he is an old friend of mine who came to see me last night and Mr. Abramoff who I consider to be a hero of American innovation—stand up, Mr. Abramoff.

Now this is a man who put $3 million into a new technology, a new water technology, and he has it tested at the University of North Carolina, was it, in Asheville, and he has got his report, and he has developed this new technology that is going to—and I am not going to describe it in detail—but it really will make the clean-up of certain water wastes and toxic wastes much more effective.

I am not going to summarize for you, but the bottom line is it is brand new and it deals with making some of the things we are doing much more effective by tenfold, or whatever.

How is this man—okay, he spent his own money; he has got the results now—what is he going to do to come to you and to make sure that this technology is being considered and—I mean, one of those you said by side-by-side comparisons that you were talking about in your testimony? What does an innovator do?

Dr. HUGGETT. I will answer this, but I must admit that not having seen his technology I do not know what contaminants he is

talking about, whether they are microbial or whether they are trace metals, whether they're dissolved organics, or what. But first of all, if he has this technology it is my understanding he is free to go to a contaminated site owner and try to get that site owner to use it.

Now the real question in this case is whether the site——

Mr. ROHRABACHER. Where would people like this get the list of contaminated sites? Do you provide that?

Dr. HUGGETT. Well, there is the NPL list. There is this list of Superfund sites that is published.

Mr. ROHRABACHER. Now, Mr. Dyckman, feel free to jump in on this, is the person who owns that site and he wants to clean it up, is he actually free to use this new technology?

Dr. HUGGETT. At his own risk.

Mr. ROHRABACHER. At his own risk?

Dr. HUGGETT. Yes. At any case, it's his own risk.

Mr. ROHRABACHER. Sure.

Dr. HUGGETT. The question is whether or not the site owner would more likely buy this technology, if you will, if it had a verification program from EPA; or, whether they would take the program verification from N.C. State or wherever the data were obtained.

That is the question.

Mr. ROHRABACHER. How does someone with new technology get into the verification program?

You talked about side-by-side comparison.

Dr. HUGGETT. That is part of the site program, where we advertise. We accept proposals from people like this gentleman that have a technology that they would like to have verified.

We then review these proposals for the scientific credibility, for the need, for the various—you know, depending on the various types of sites, and it sounds like he has something we would certainly have a need for.

These are peer-reviewed, and then we select those who enter into the SITE Program. And we would provide the verification and publish the results of that verification.

Mr. ROHRABACHER. Mr. Dyckman, are they doing—is EPA doing a good job at that so that the people in the private sector like Mr. Abramoff who put their money out and develop new products are able to actually see that the new technology is put to use for benefitting our country?

Mr. DYCKMAN. Well, the last time we did a full-blown view of the SITE program was probably in 1993. The review that we have done, and we are about to issue a report on, basically deals with incineration, just one aspect of cleanup technologies.

We did note that one of the problems with the SITE program—it is not a major flaw, but it is a significant problem, though, is that when you test a technology in the SITE Program you are basically testing it with a very small amount of contamination.

Therefore, it is difficult for EPA and the demonstrator to look at the implementation problems if you went to a full-scale use of that technology. And that has been a problem for EPA project managers who manage EPA Superfund sites in terms of trying to find an in-

novative technology that they can use, and that they have some confidence that it will work on a large site.

That is one of their problems.

They have had other problems in the past that they have tried to and are working on correcting in terms of trying to get their reports out earlier, being more timely, in terms of identifying—they should be complimented for that in terms of identifying the types of remediations that are priority remediations and the contaminants that need to be addressed.

One thing we do note, though, is that if you look at the list of the technologies that SITE finances, and we have provided a list in Appendix 2 on page 12 of our full report, you will notice that two or three technologies—soil vapor extraction, thermal desorption, and some of the bioremediations—those account for almost half of the technologies, new technologies that SITE has funded, and one wonders whether or not EPA is identifying sufficient technologies to help the Superfund Program.

Because most of the soil vapor extractions, 133 out of the 291 technologies at EPA sites, are basically the same, it's my understanding that it is one technology, not 133 different technologies.

So that is another concern in terms of whether or not EPA is identifying and supporting sufficient technologies, possibly, like your friend's.

Mr. ROHRABACHER. Dr. Huggett, go right ahead and answer that and then I will open up the questioning to other panelists.

Dr. HUGGETT. We strive to focus our efforts in areas where there is the greatest problem. When you talk about bioremediation, we talk about soil venting, or whatever, we are talking about organics in soil. This happens to be where most of our problems are, so I think it logical that we focus our efforts in those areas.

We do not consider a technology "innovative" until we have enough data to solve the problem that Mr. Dyckman mentioned of applicability across the broad scale. Until we have scientific and technical information that we can say this will work exactly here, here, here, and under these conditions, we consider it innovative.

Now I will admit that it probably does not sound like thermal desorption, take a soil and heat it somehow so that it loses the contaminant, is terribly innovative; the problem that you have is exactly under what conditions do you heat it? How high? How long? How do you capture the material?

That is the type of things we are working on at this time. We have completed demonstrations on 82 different projects. We have ongoing 5. In 1992, we had 19 participants in this program. In 1993, we had 15. In 1994, we had 18. And we are in the process of soliciting right now.

So again to get back to your previous question of how someone would enter into our program, that is the mechanism. Our program for Site is, approximately, in 1995 I believe it is around $11 million.

Mr. ROHRABACHER. Well I am very pleased that so far we have not heard anybody talk about lawyers clogging up the pipes and the glut of lawyers in the EPA, this shameless glut of lawyers. So I am pleased that that has not been mentioned yet.

So that is not a major problem that we are looking at in terms of this particular hearing.

I would like to ask our distinguished Former Chairman of the Science Committee if he would have some questions now for you.

Mr. Brown?

Mr. BROWN. Thank you, Mr. Chairman.

I do not want to be lengthy, but in reading your statement, Dr. Huggett, there is a line on page 4 which intrigued me and I wondered if you could elaborate on it a little bit.

Down at the—this is in connection with Risk Assessment Research which is one of the more popular topics here on the Hill. You have indicated that you have worked to replace linear dose response models with more plausible biologically based models.

Unless they were a sheer mathematical creation, I was not aware that you could have dose response models that were not based upon biological experimentation.

I am sure you are trying to encapsulate a broader message here. Would you explain to me just what it is?

Dr. HUGGETT. Yes, sir. Indeed the dose response models are based on either biological models or the use of biological organisms such as dosing guinea pigs, rats, mice, et cetera.

Mr. BROWN. Well the part that I am most familiar with is the FIFRA program which requires manufacturers of products that are covered to submit extensive tests with regard to dose response.

Dr. HUGGETT. The linear dose response model assumes that if you have a response at a high concentration that you basically extend the line down to zero, and that you would have a response potentially I suppose from one molecule of the substance.

Mr. BROWN. But we know that that is not correct.

Dr. HUGGETT. That is true.

Mr. BROWN. Now how do you work into this kind of research?

Dr. HUGGETT. What we are doing is using pharmacokinetic models and trying to determine what the threshold of the effect is.

So the line may not be straight going through zero, but rather be flat on the X axis for some point until the concentration is high enough to elicit effect.

It may be, for instance, that the body's immune system was able to cope with an insult up to a certain point over which it can't——

Mr. BROWN. Is that what we call a "hockey-stick curve?"

Dr. HUGGETT. Yes, sir.

Mr. BROWN. Do you work with the people in FIFRA to review the data that they are getting, which is provided at great expense by private manufacturers?

Dr. HUGGETT. Yes, sir. It is not necessarily a part of this program, totally, but we do. We are responsible for conducting much of the research in EPA in support of the other program offices, including FIFRA, TOSCA, et cetera.

Mr. BROWN. Yes.

Well, I would want to be assured, and I would think most of the Committee would, that we do have some coordination in this extremely important risk assessment research field. I am going to take it that you are reassuring me that this indeed is the case.

Dr. HUGGETT. Indeed we are, sir, and I would be glad to provide information. In fact, our recent reorganization of the Office of Re-

search and Development is around the risk assessment paradigm with the National Exposure Lab, the National Effects' Lab, the National Risk Management Lab that Mr. Oppelt manages, as well as the Risk Assessment Center. So we take our role in Risk Assessment to be very important.

Mr. BROWN. Thank you very much.

Dr. HUGGETT. Thank you, sir.

Mr. ROHRABACHER. Thank you, Former Chairman Brown, and now to our acting Ranking Member——

Mr. ROEMER. Acting acting.

Mr. ROHRABACHER. Acting acting—hopefully, our permanent.

Mr. ROEMER. Thank you, Mr. Chairman.

I am delighted to have Dr. Huggett and Mr. Dyckman before our Subcommittee this morning. I think their answers and their testimony have been very helpful and enlightening so far.

Mr. Dyckman, I would like to ask you a question or two about your methodology and become a little bit more familiar and comfortable with it.

In the process of evaluating the site program, did you interview representatives of the firms that had participated in the program?

Mr. DYCKMAN. No. As I mentioned, we did not do a complete evaluation. We were doing a review for another requester of use of incineration technologies, primarily at three Superfund sites.

We had earlier done a review and testified in 1993, and we were requested by the Chairman's office if we could update quickly some of that information. So we did not have a chance to interview people from specific private firms.

Mr. ROEMER. Now if you had had more time, would this have been a high priority of yours to actually talk to some of the participants?

Mr. DYCKMAN. Right. If we were asked to evaluate the usefulness of the SITE Program, we would come up with a methodology which would include speaking to private companies that have used SITE effectively.

There have been some firms that have dropped out of SITE. We would probably speak to them. We would also want to speak to innovators that have been able to get their technologies on the market without the use of either federal funds or EPA funds.

Mr. ROEMER. Is this something that you would consider doing if the Committee drafted a letter to you to do an objective analysis based on that kind of methodology——

Mr. DYCKMAN. Sure.

Mr. ROEMER. [continuing] —in talking both to the people that respond positively to the SITE Program——

Mr. DYCKMAN. Right.

Mr. ROEMER. And those who have dropped out for various reasons?

Mr. DYCKMAN. Yes. We would work with the Committee and its staff.

Mr. ROEMER. How long would that take?

Mr. DYCKMAN. Off the top of my head, I would imagine that—first we would probably want to expand it to beyond just talking to demonstrators. We would want to look at, for example, some of the claims that EPA has made in terms of the cost savings, because

I think that is an important aspect of evaluating the effectiveness of a site.

I do not want anyone to get me wrong. We do not have a position, GAO, in terms of how effective SITE is. We have some concerns. We have done some work in the past, but not the broad, in-depth type of study that would allow us to have an informed opinion in terms of the actual effectiveness of the program.

But in any event, to answer your question. I would imagine it would take us about three or four months, maybe up to six months depending on how elaborate our methodology was, including testing some of the data that Dr. Huggett had mentioned in his testimony concerning the cost savings.

Mr. ROEMER. Well I think it would be very important to talk to those participants, both those who have been pleased and those who have been disappointed in the program.

Let me ask you. In terms of your testimony, you have stated some of the regulatory barriers involved in the Superfund process in remediation. We are hopeful that when we visit Superfund reform, whether it be through Mr. Oxley's bill, or a combination, a hybrid of Mr. Oxley working with Carol Browner at the EPA, that we address some of these regulatory problems.

What specific recommendations do you make, Mr. Dyckman, in terms of improving this program to promote the development and use of more cost-effective technologies apart from those regulatory barriers that we hope we will address through the regulatory reform process?

Mr. DYCKMAN. Well, as you mentioned, the ARARS, which is the state regulatory framework for Superfund, softening that or eliminating that would probably help the Innovative Technology Program, although I have to say that that in my opinion should not be the goal.

The goal is not to increase technologies but to improve Superfund in general. So you do not really want to approach it in terms of trying to legislate something just to improve innovative technologies. You want to legislate something to improve the effectiveness of Superfund and the ability of EPA and private parties to clean up sites quickly and effectively and less costly.

But putting that aside, some of the barriers over time—for example the barrier that we mentioned dealing with having good cost and performance data—some of the innovative technologies that are still being funded are almost at the point where EPA is being able to put together cost and performance data, so over time that barrier should be somewhat reduced.

Mr. ROEMER. I would appreciate it if you could give me an answer, too, in writing to that. I know that that might take some time and maybe some further evaluation.

Mr. DYCKMAN. I would be happy to do that.

[The following information was received for the record:]

Some barriers, such as limited cost and performance data and technical limitations, are inherent in any new technology and will eventually be overcome through increased usage and further development of the technology. To this end, the reauthorization bill currently being considered should help through its provisions encouraging the testing of innovative technologies at federal facilities. Other barriers, such as regulatory standards and the lack of investment incentives, need to be lessened or removed through agency or congressional action. Again, the reauthorization bill's

provisions to reduce the number of federal and state requirements potentially applicable to Superfund cleanups might make it easier for innovative technologies to meet cleanup standards. If innovative technologies have an easier time meeting cleanup standards, more investors may be willing to invest in them since there should be more of a market. However, the goal of regulatory reform should not be to increase the use of innovative technologies but to improve Superfund program effectiveness in general. Legislation should improve the ability of EPA and private parties to clean up sites quickly, effectively, and less costly.

Mr. ROEMER. Finally, Mr. Chairman, let me just get to Dr. Huggett for a quick question or two.

What have been the primary reasons for the participants in the Site Program to have dropped out?

And then finally, what is the range in savings that have been achieved at the 17 sites that you evaluated?

Dr. HUGGETT. I would like to ask Mr. Oppelt to respond to why the people dropped out, if possible, because I have only been here 18 months and many of them dropped out before I came, if that is permissible.

Mr. ROEMER. That is permissible. If you would, I guess for the Committee, state your name and position.

STATEMENT OF TIM OPPELT

Mr. OPPELT. Yes. I am Tim Oppelt. I am the Director of the EPA's National Risk Management Research Laboratory in Cincinnati.

We have had a small number of the developers and vendors of technology that have been accepted into the program either drop out voluntarily or be asked to drop out by the agency.

The principal reason is—there are several reasons, actually. One is that they do not have yet a full-scale operating piece of equipment when they apply to the program. We require this. If it turns out that it is not operating effectively, then that will delay the time they can get to a site.

Another reason is that we will identify sites for them that would seem to match that technology's applicability. The owners of the technology have a right to say, "No, we do not think that site is really applicable for us." Typically that has been the other reason that they have postponed the selection of the site sufficiently long that we exit—it is called "exiting them from the program."

There have been about 15 companies that have gone through that process over the last three or four years.

Mr. ROEMER. What is the range of savings in the 17 sites that you have evaluated?

Mr. OPPELT. I would turn that back to Dr. Huggett.

Dr. HUGGETT. Yes. Sir, the cost over the standard type of treatment was $358 million. As I mentioned, that, if you average it out, is $21 million per site.

Mr. ROEMER. Thank you, Mr. Chairman.

Mr. ROHRABACHER. Thank you, Mr. Roemer.

Now we will turn over questioning to Mr. Zack Wamp from Tennessee. We call him "fighting Zack" because he is a tough guy and a really smart guy and we are really happy to have him on this committee.

Mr. WAMP. Thank you, Mr. Chairman.

I have a short statement, and then two questions.

As a member of the Speaker's Task Force on Nuclear Cleanup and a representative for the Oak Ridge Complex in Oak Ridge, Tennessee, I just want to say I approach Superfund cleanup from two perspectives.

One is the federal perspective, and the other is private cleanup of sites, of which we have a major Superfund site in Chattanooga called Chattanooga Creek, which was just added to the NPL listing. But I also take a moderate approach to who is responsible and not letting anyone off as we approach a more efficient process.

But I want to promote the nuclear task force's efforts and proposals through the Hastings bill for efficiencies. I think we have to recognize at every hearing like this that until we establish *de minimis* levels of how clean is clean and some of these fundamental questions, we are kidding ourselves to talk about what we can do to improve efficiencies until we address these basic questions, and then go forward with our reform proposals.

I would suggest that anyone really interested in particularly the federal cleanup efforts of Superfund sites to analyze what our task force has recommended. about 20 different initiatives that we believe will dramatically improve the efficiency and save billions and billions of dollars over the next 50 years in this country as we seek to identify which sites need to be cleaned up, how far they are going to be cleaned up, what the federal responsibility will be, and what the private sector is expected to pay.

I have a basic question for Dr. Huggett:

How is the EPA linked as an overview to our National laboratory systems—you mentioned working with DOE—particularly the national laboratories' research, and our institutions of higher learning, our colleges, MIT and others that you may be linked with, how are you linked in terms of your efforts—and give me as much concrete justification for your research efforts in terms of this linkage, not just we work with, we cooperate with, that's expected—I mean, how do you do it?

Dr. HUGGETT. Yes, sir. Thank you. Perhaps I could use Oak Ridge National Lab as an example.

Personally I have been involved with the scientists at the Oak Ridge National Lab for over 20 years. I have given a number of seminars there. I am very supportive of their research, and I admire their work.

Since I have come to EPA, which is approximately 18 months ago, I have formally visited the Oak Ridge Lab. I have talked with Mr. Travelpiece, the Director; I have talked to Mr. Rikert in charge of the Ecology Division; and in fact we had planned actually this week—it is odd that you state this—to have my lab directors, as well as my science deputies at each of our laboratories—to visit the Oak Ridge facility to actually what I call "go in and kick the tires." Go through the research facility. See what people are doing. Ask why they are doing it. And then allow them to talk with us to see where we have common interests, where we can support their research, where they can support our research.

I noticed when I was there, for instance, that they were doing work on cryptosporidium, which is a protozoan in drinking water that is of great interest to the Environmental Protection Agency because of the outbreak of cryptosporidiosis in Milwaukee.

They were doing it because it was an experiment with a particle and something called polymerase chain reactions. We were interested in the work because of the public health implications.

So we have initiated this program. Unfortunately we were not able to pull off this visit because of the continuing resolution that we are under now. Hopefully that will cease. In fact, I had another visit that was scheduled for this Friday to go to the Brookhaven National Lab for the same reason.

So we are trying as best we can to make sure we are aware of what is going on there, and that they are aware of what we are doing.

In addition, we have conducted joint demonstrations of Superfund cleanup with DOD and DOE where we actually work together.

Mr. WAMP. What about colleges and universities?

Dr. HUGGETT. Colleges and universities are an extremely important part of our program. We have increased our funding for research to universities and to not-for-profit organizations by peer-reviewed proposals in areas that we need work in 1995 from $22 million a year to $44 million a year.

In the President's 1996 budget, it is at $86—$85 million, excuse me, a year.

Involving the academic community in our work is essential. I must say that we have not done it very well in the past, but we are dedicated to doing it more in the future.

Mr. WAMP. I have a follow-up for either gentleman.

How can we use our Tax Code in terms of trying to find solutions, or some kind of empowerment incentives for certain contaminated areas of Superfund sites to encourage particularly small companies to invest in this kind of research?

As you said, Dr. Huggett, the big companies can do it. How can we use our Tax Code to encourage small companies to invest in research and development?

Mr. DYCKMAN. That is a tough one. I would have to think about that and maybe provide something for the record. Offhand, it would be kind of difficult for me to give an off-the-cuff response to that. That is a pretty meaty question.

Mr. WAMP. That is for another hearing on another day. Thank you, gentlemen.

Mr. ROHRABACHER. Mr. Wamp, thank you very much.

We will have Ms. McCarthy from Missouri?

No questions.

Mr. Ehlers from Michigan, our in-house scientist who we are always very pleased to have with us at these hearings.

Mr. EHLERS. Thank you. It is certainly better to be an in-house scientist than an out-house scientist.

[Laughter.]

Mr. EHLERS. Two quick questions first, and then a longer one.

Dr. Huggett, I was noticing the list of centers we have at various universities. There is a tremendous range in the types of institutions on the list ranging from at the very top, at least I think the very top, the University of Michigan on through a number of others.

Are these selections of these centers peer reviewed? What about the ones that were earmarked by Congress? Did they go through any sort of evaluation process, or were they simply imposed upon you by Congress?

Dr. HUGGETT. There is a mix of that, sir. Some were earmarked directly, are earmarked directly, and some were peer reviewed.

I personally believe that anything that we do to fund outside research, not contracts but research, not goods and services of a scientific nature, should be peer-reviewed. And they should be peer-reviewed periodically, and they should have performance checks as in between the cycles.

Mr. EHLERS. So the five that were selected were peer reviewed? The three earmarked by Congress were not?

Dr. HUGGETT. Yes, sir. The five I believe are up for—what is it, '97 or '99?—in 1999. I think it interesting to note that in the formation of these centers it was assumed that this funding would help them to become more independent. In other words, it would bolster their capabilities so that they would then be in a position to go ahead and continue with receiving funding from other organizations, peer-review grants, and so forth.

I think that is something we are going to have to look at very, very carefully to see whether or not they are at that point. And, if so, I think that we need to re-solicit.

Of course we would evaluate whether or not we should have them.

Mr. EHLERS. I know that did happen in Michigan where in fact they formed a consortium of not just the University of Michigan, but MSU, the oil industry put in a substantial amount of money, and they have been quite successful in bioremediation programs.

Dr. HUGGETT. Yes, sir.

Mr. EHLERS. Mr. Dyckman, a quick one.

Do you have a scientific background of any sort?

Mr. DYCKMAN. No. I am an accountant by training.

Mr. EHLERS. And finally a question for both of you.

It seems to me that one of the big problems in getting the program going, just listening to your testimony and reading through the written comments you made, is the lack of regulatory flexibility in allowing innovative technologies to be tested on sites without a very large risk to the people doing it.

I am wondering if it would be helpful to look at legislatively relaxing the regulations for pilot programs and testing innovative technology to encourage the use of, or the testing of, these technologies, and getting away from the fact that someone may have to plunk down $10 million and they may lose it all because it does not meet the strict regulatory criteria, and they have lost it all and they have to go back and do it some other way.

I would appreciate comments from both of you on whether we as a Subcommittee should be looking at trying to relax that regulatory authority for test sites.

Dr. HUGGETT. I appreciate that comment, and I would be supportive of working with you and the committee in any way we can.

As you know being a scientist, the importance of good protocols for testing, good quality assurance, et cetera, that would have to

stay. The question is whether or not by different legislation we could reduce the risk to the developer.

We would be more than happy to work with you. I would hope that that could happen.

Mr. DYCKMAN. It is my understanding that the House bill to reauthorize Superfund does allow, or permit testing of new demonstrations at federal facilities, which has been used by EPA in the past, and I guess this would encourage more of that.

So that I think would help in terms of providing a real site and removing some of the barriers that you mentioned and that we mentioned.

Mr. EHLERS. Well, thank you. And I know the Chairman of this Committee is certainly interested in reducing the regulatory overburden.

I guess for a follow-up, I would appreciate it if both of you could send me a letter, and also the Chairman of the Subcommittee a letter, rather specifically analyzing what the new version of the bill says on this, and whether you think it will accomplish the goal.

And, going beyond that, how you think it should be written to really accomplish this goal.

Thank you very much.

[Responses from GAO and Dr. Huggett to the question of Hon. Vernon J. Ehlers follow:]

RESPONSE OF GAO

We believe that 3 provisions of HR 2500, the Reform of Superfund Act of 1995, could affect the amount of research and development done on innovative technologies to clean up Superfund sites. These provisions include:

(1) the designation of federal facilities on the National Priorities List that would be made available to facilitate the research, development, and application of innovative technologies for remedial action at the facility;

(2) the elimination of the existing requirement that remedies comply with all "applicable, relevant and appropriate" federal and state standards and instead be based on an assessment of site specific conditions and risk; and

(3) the elimination of the existing preference for treatment to reduce the volume or toxicity of the contaminants.

GAO has not done a complete analysis to determine what impact these provisions might have on the development and use of innovative technologies, but based on the information we have reviewed, the designation of federal facilities to facilitate research and development appears to address problems identified in prior reviews of EPA's research and development efforts. For example, EPA's Superfund Innovative Technology Evaluation (SITE) program has experienced difficulty in finding appropriate locations where prospective new technologies could be demonstrated. In fact, this has been a reason some technology vendors have been dropped from the program. In addition, a benefit of conducting demonstrations on federal facilities is that actual field-scale data could be obtained, allowing for a meaningful performance evaluation of the technology. Recognizing the potential benefits of such a program, EPA recently entered into a cooperative agreement with Clean Sites—a nonprofit corporation whose mission is to promote the cleanup of hazardous waste sites—to demonstrate full-scale applications of innovative technologies at several federal facilities. Seven demonstrations are in progress; however, data are not yet available on their outcomes. This legislative proposal would expand and facilitate that effort.

The impact of the elimination of the remaining two provisions currently contained in CERCLA is more difficult to assess. The proposal to eliminate the current requirement that remedies comply with all "applicable, relevant and appropriate" federal and state standards and instead be based on an assessment of site specific conditions and risk illustrates this difficulty. As we discussed in our testimony, a barrier inhibiting the further development and widespread use of innovative technologies is the difficulty that these technologies often have in meeting existing regulatory cleanup standards. Some of these standards are based on the performance of existing technology. Thus, the elimination of this requirement could result in inno-

vative technologies, in some cases, having to meet fewer or less stringent cleanup requirements. The substitution of the existing requirement with cleanup standards based on an assessment of site specific conditions and risks, however, could increase the uncertainty about future regulatory cleanup standards which we said was a disincentive for private industry to invest in innovative technologies.

The proposal to eliminate the current CERCLA preference for treatment rather than containment is also difficult to assess. This could result in the development of innovative containment technologies at the expense of research and development of innovative treatment technologies that would permanently eliminate or reduce the volume of the contaminant. However, the long-term costs and benefits associated with these alternatives are uncertain.

RESPONSE OF DR. HUGGETT

Question: What barriers could be removed from the current process to facilitate the testing of innovative remediation technologies at Superfund sites?

Answer: From our experience over the past ten years with demonstration programs such as the Superfund Innovative Technology Evaluation (SITE) program, we have identified several barriers to innovative technology development and demonstration which could be remedied. These remedies are as follows:

- Federal Facilities. Federal facilities should serve as a model for remediation demonstration projects. They should be encouraged to participate in demonstration projects by involving EPA in evaluations of their existing or proposed cleanup technologies, and by nominating sites for technology demonstration. This is beginning to happen and could be reinforced by recommending that Federal facilities cooperate with EPA in demonstration programs where there is mutual interest. An added economic incentive for their participation results from the leveraging of EPA demonstration project resources and expertise (e.g., from SITE) to Federal facility demonstration funds.
- Treatability Studies. At present, no permit is required for vendors conducting treatability studies at Superfund sites where permit requirements are waived by CERCLA section 121(e). SITE program enabling legislation envisioned that there might be cases where vendors might prefer to conduct tests at their own facilities or other locations. Use of other than Superfund sites to conduct treatability studies may experience costs and delays associated with permitting unless the facility is located in a state which has adopted EPA's treatability study rule in either its original or expanded form.
- Liability. Vendors performing approved EPA treatment technology demonstrations, treatability studies, or development projects are not protected from prosecution in the event of a spill, accidental release, or creation of an increased problem as the result of a treatment test at non-NPL sites. At present the protection for vendors is only applicable at NPL sites.
- Access to sites. We have had problems with site access for some demonstration projects at responsible party/potentially responsible party sites. In addition to the normal information gathering access and entry for inspection and sampling visits, it would help to conduct treatability studies using site waste, and to conduct demonstrations at these types of sites.

Mr. ROHRABACHER. Thank you, Mr. Ehlers.

We have been joined by Mr. Fawell, I understand.

Mr. Fawell, do you have any questions to the panelists?

Mr. FAWELL. No, Mr. Chairman. Thank you.

Mr. ROHRABACHER. Okay. Thank you very much, Mr. Fawell.

I would like to close with a few questions.

Dr. Huggett, EPA funds eight exploratory centers to do Superfund R&D as we have talked about today.

How much does EPA spend annually on these centers?

Dr. HUGGETT. The total cost is $14.5 million, sir.

Mr. ROHRABACHER. Were they competitively established?

Dr. HUGGETT. Five of them were, three of them were not.

Mr. ROHRABACHER. And those that were competitive, do they have to re-compete for their funding? Or is it once they are funded they just continue?

Dr. HUGGETT. They will have to re-compete—well, they will be up for the decision to re-fund them in 1999. I would like to look at the possibility, first of all, as to whether that is the proper way to spend—the competed grants for centers are $5 million.

I think an evaluation is necessary to determine whether or not that is the appropriate way to get the best research. And, if so, I personally believe that they should be re-competed, not just go back.

Mr. ROHRABACHER. As we bring this hearing to a close, let me say that I have been very impressed by the testimony from both of you.

I think that we have benefitted greatly from the dialogue that we had.

Dr. Huggett, just to be fair to you, do you have any questions that you would like to ask Mr. Dyckman?

[Laughter.]

Mr. DYCKMAN. I was waiting for that.

Dr. HUGGETT. What are the three laws of thermodynamics?

[Laughter.]

Mr. ROHRABACHER. Mr. Schmidt, could you handle that?

[Laughter.]

Mr. ROHRABACHER. I would like to thank you again. Again, I just mentioned briefly in passing about how I was so happy that we did not hear about lawyers clogging up the tubes in the process.

We need to make sure that government is doing what it needs to do, and that those things that can be done in the private sector are being done in the private sector, and those things that government does do what it does efficiently and effectively.

I think that on both sides of the aisle we are committed to that. We are making sure that the taxpayers get their money's worth.

I appreciate your dedication, Dr. Huggett, and your diligence, Mr. Dyckman, and together we are going to make sure this country works and moves ahead.

So thank you very much.

Dr. HUGGETT. Thank you.

Mr. DYCKMAN. Thank you.

Mr. ROHRABACHER. The hearing is adjourned.

[Whereupon, at 11: 15 a.m., December 6, 1995, the hearing was adjourned, subject to the call of the Chair.]

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